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(54) Tooth configuration for an idler sprocket in the nose of a chain saw guide bar.

(57) A chain saw guide par for guiding an endless saw chain has a sprocket rotatably mounted in the nose of the bar to elevate and transport the saw chain around the nose end. The teeth of the sprocket engage the drive links of the chain to lift the chain off the nose edge as the chain traverses the nose. The tooth tips project above the side link bearing surfaces and into configured notches whereby the teeth effectively provide the lifting action without entering the saw chain chassis.

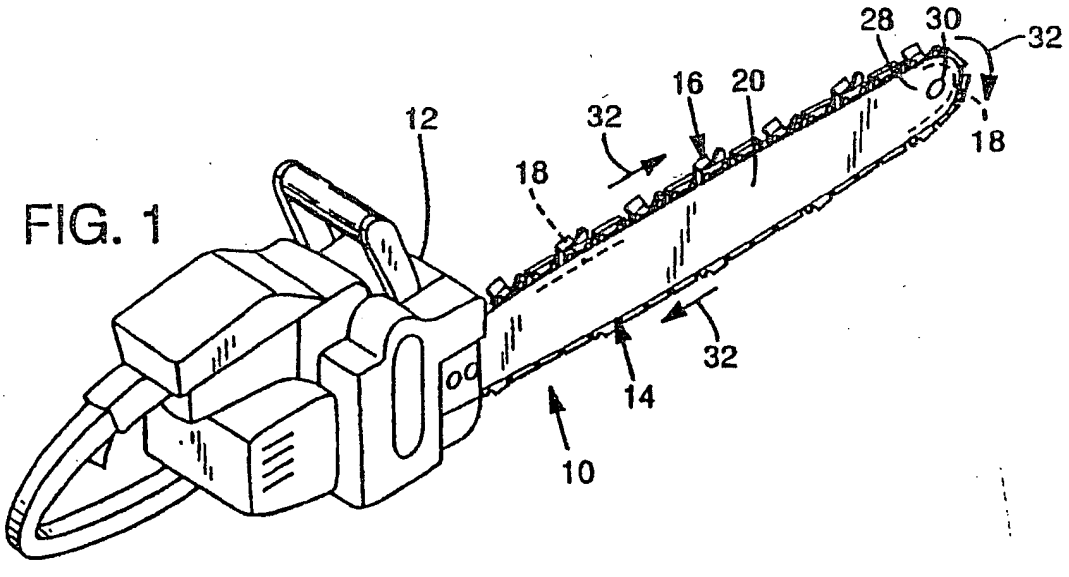

FIG. 1

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CHAIN SAW GUIDE BAR WITH SPROCKET

This invention relates to a chain saw and more particularly to an improved tooth configuration for an idler sprocket in the nose of a chain saw guide bar.

Motorized chain saws have an elongate guide bar on which a saw chain travels. The bar is attached to a side of a housing of the chain saw power head with one end of the bar aligned with a drive sprocket that is driven by the drive shaft from the power head. The opposite end of the guide bar (referred to as the nose end) is generally semi-circular and it blends the top edge of the bar to the bottom edge.

The drive sprocket drives the endless articulate saw chain around the guide bar as a result of the engagement of the drive sprocket teeth with depending portions of the saw chain referred to as drive tangs located on the centre links of the saw chain or centre drive links. The saw chain has, along its length, a plurality of alternating right and left hand cutter links that are side-mounted in reference to the centre drive links. Each cutter link is pivotally attached (by a pin or rivet) to a right or left side of adjacent drive links. A tie strap link, having the same lower body configuration as the cutter link, is provided on the side of the drive links opposite the cutter link. The tie strap and cutter links, all being attached to the left or right hand side of the drive links are referred to collectively as side links.

Accordingly, the saw chain sequence typically consists of alternating canter drive links and interconnected pairs of side links, the side links being paired cutter links and tie strap links (a full house chain) or every other pair of side links may be paired tie strap links to space the cutters along the chain length (skip tooth chain). The centre drive links travel in a peripheral groove in the guide bar to guide the saw chain as it travels around the bar. The pair of side links (a cutter link and a tie strap or a tie strap pair) of the saw chain ride in frictional contact on the side rails or edges of the groove and thus provide the necessary bearing support for the chain during the cutting action. The bottom edge of the cutter links and the tie straps are notched between their pivotal mounting points to approximate a fit to the changing bar contour and to accommodate certain types of drive sprockets.

The highest rate of wear occurs at the nose section of the bar as the chain travels from the upper edge of the bar in a curvilinear path to the lower edge of the bar. To alleviate the wear rate and to aid in transporting the chain around the nose section, an idler sprocket or note sprocket may be rotatably mounted in the note of the bar. The nose sprocket is rotatable about an axis slightly forward of the centre of the radius of the bar nose to smoothly engage and lift the saw chain. The nose sprocket has a different function form, and is not to be confused with, the drive sprocket. The nose sprocket is propelled by engagement of the drive tangs of the saw chain's centre drive links with the teeth of the nose sprocket. The sprocket is so positioned in the nose of the bar that it lifts the side links of the chain slightly off the rails as the chain traverses the nose of the bar.

In a conventional nose sprocket guide bar, each tooth of the sprocket enters between adjacent drive links, with the tip of the tooth extending into the chassis of the chain, that is, so as to be positioned between laterally opposite side links, with the tooth tip extending above the top of the notch in the side links. This was heretofore though to be a desirable feature to provide stability to the saw chain as it travelled around the bar nose.

The nature of the alternating right and left hand cutter links is such that in a cutting operation they exert forces on the saw chain which tend to twist the chain as well as to laterally urge the saw chain out of its intended path. These twisting and lateral forces are hereafter collectively referred to as "lateral forces". In normal cutting conditions the drive tangs of the centre drive links are entrained in the bar groove so that the engagement of the drive tangs with the groove walls absorbs the lateral forces. When the nose section of the bar is in the cut, the lateral forces are at least partially applied to the portion of the sprocket teeth tips projected between the side links. Sprocket teeth and bearings are unable to withstand these lateral forces and undue wear or breakage of the sprocket is common.

The lateral forces can also shove the saw chain and the sprocket teeth out of alignment at the point where the saw chain starts to mount the sprocket. The tip of the sprocket tooth in such an instance may then contact the bottom of a side link, lifting the chain further than intended so as to raise the drive tangs out of the bar groove. This condition can result in the chain being thrown off the guide bar. This can result in further damage to the chain saw and saw chain and may be a safety risk to the operator.

It was found that chamfering the tip of the sprocket tooth aided the tip to "find" the opening between the side links for centering the chain on the bar nose. However, it was found that on occasion the chain and the sprocket could still get sufficiently out of alignment for the tip of the tooth, although chamfered, to come into contact with the

bottom edge of the side link and thus cause the chain to jump off the bar as described.

The chamfering of the sprocket was an added operation during manufacture and of course added to the cost. The problem constituted by the jumping of the chain off the bar, because of the sprocket tooth tip engaged the bottom edge of the side link, was reduced but not eliminated, and the problem of the sprockets having to bear the severe lateral forces during a nose cutting operation still resulted in rapid wear and breakage of the nose sprocket.

In accordance with the present invention, the idler sprocket teeth and the side links of the chain are so shaped that the teeth do not enter between the side links.

The invention thus eliminates the added process step of chamfering the tip of the sprocket and further eliminates the wear and breakage problem of the sprocket without sacrificing performance. The nose sprocket has configured teeth which achieve the desired lifting of the chain off the bar nose rails but which do not incur the danger of engaging the side link bottom edges. The sprocket teeth are configured to "fit" the opening defined by a leading and following drive tang in the condition where the saw chain is wrapped around the bar nose. The teeth project between the drive tangs to engage the flanks of the drive tangs just below the bottom of the side links.

Because the teeth have no portion projected up between the side link pairs in normal operation, the lateral forces resulting from engagement of the saw chain side links by the sprocket teeth are avoided. If misalignment does occur, any lifting that results is no more than what occurs in normal operation and the sprocket cannot be the cause of the drive tangs being lifted out of the bar groove,

The invention is further described below, by way of example, with reference to the accompanying drawing, in which:

Fig. 1 is a perspective view of a motorised chain saw in accordance with the invention; and

Fig. 2 is a sectional side view on a larger scale of the nose portion of a sprocket nose guide bar of the chain saw of Fig. 1.

The illustrated chain saw 10 includes a power head enclosed by a housing 12 and an elongate guide bar 14 attached to the housing 12. An articulated endless saw chain 16 is guided in a peripheral slot or groove 18 with side rails formed in the peripheral edge of the guide bar 14. At the nose 28 of the guide bar 14 an idler sprocket 30 (see Fig. 2) is rotatably mounted between side laminates 20, 22 of the guide bar 14. A centre laminate 21, which spaces the side laminates 20, 22 apart, forms a cavity for an idler sprocket 30 and provides the bottom of the guide groove 18. The side laminates 20, 22 each have a top edge 24, a nose edge 25, and a lower edge 26. The sprocket 30 is rotatably mounted on bearing 22 running on an inner face secured between the side laminates 20, 22 in the nose 28 of the guide bar 14. In operation the saw chain 16 is propelled by a drive sprocket (not shown) in the direction indicated by arrows 32.

As best appears from Fig. 2, the sprocket 30 has a plurality of equally spaced, radially extending, symmetrical teeth 34. Gullets 42 are formed between adjacent teeth 34 to accept drive link tangs 56 of drive links 50 of the saw chain 16. Each tooth 34 has a leading face 36 and a trailing face 38, the faces 38, 36 of adjacent teeth providing supporting landing areas for the flanks of a saw chain drive link 50. The sprocket teeth 34 are configured to elevate side links 46, 48, 54 of the saw chain 16 off the nose edge 25 as the saw chain 16 traverses the nose 28 of the guide bar 14. Note the travel path 27 of the bottom edges of the side links 46, 48, 54.

At the point of entrance, where the saw chain 16 first encounters the sprocket 30, the leading flank 58 of the drive link 50 engages or abuts a trailing face 38 of a sprocket tooth 34. Further movement of the saw chain 16 rotates the sprocket 30 and the depending tang 56 of the drive link 50 enters the gullet 42 between the teeth 34. The trailing flank 60 of the drive link 50 then abuts the leading face 36 of the following tooth 34. Thus the drive link 50 of the saw chain 16 is supported on the faces 38, 36 of adjacent teeth 34 as the saw chain 16 traverses the nose 28 of the guide bar 14. Correspondingly, each tooth 34 is projected between leading and following drive tangs whereby a leading tooth face 36 engages the trailing flank 60 of the leading drive tang, and the following tooth face 38 engages the leading flank 58 of a following tang.

The abutment of the drive link flanks 58, 60 with the faces 38, 36 of adjacent teeth 34 elevates or lifts the saw chain side links off of the nose edge 25 of the side laminates 20, 22 as illustrated by the path 27. The bottom edge of the side links will travel in close proximity to the nose edge 25. The tip 40 of the sprocket tooth 34 remains below the top 72 of the notch 70 which forms the bottom edge configuration in the side links.

The invention is based in part one the realization that attempting to improve lateral stability of the saw chain as it travels around the bar nose, by projecting the teeth of the sprocket into the chain chassis (between the side links), creates more of a problem than it solves. In order to achieve the lifting action without projecting the teeth between the side links, the sprocket teeth need to be configured to match the formed configuration of the leading and following drive tang flanks 60, 58 as the

drive links confirm to the curved surface of the bar nose.

With a tooth 34 fully seated against the formed configuration of the drive tangs, the tooth faces 36, 38 must engage drive tang flanks 60, 58 respectively at a position whereby the tooth tip 40 does not project up between the side links. The procedure for forming the tooth configuration to the formed drive tang configuration is illustrated in Fig. 2. The curve of the bar nose edge 25 is laid out, as in a drawing. Then the desired travel path 27 of the bottom edge of the saw chain as it passes around the bar nose is produced on the drawing. A saw chain configuration matching the curved path 27 is laid out to thereby establish the formed configuration of the drive tang and also the configuration of the bottom edge of the side links including the notch 70. The sprocket tooth configuration is then drawn to match the formed configuration of the drive tangs 56, achieving the desired surface-to-shank contact for optimum lifting action. The tooth 34 is shaped so as to terminate below the point where the tooth tip 40 would be projected between the side links, that is, below the notch top 72. Care is also taken to avoid pinching of the tooth tip 40 between the centre links.

Variations and modifications of the embodiment described and illustrated will be apparent to those skilled in the art within the scope of the invention as indicated by the appended claims.

Claims

1. A chain saw comprising a guide bar having an idler sprocket at its nose end, a saw chain on the guide bar and the idler sprocket, the saw chain having drive links and side links between each adjacent pair of drive links, the drive links having drive tangs receivable between the idler sprocket teeth, characterised in that the idler sprocket teeth and the side links are shaped so that the teeth do not enter in between the side links.

2. A chain saw comprising;
a power head driving a drive sprocket,
a guide bar having a guide bar edge defining a slot with side rails, the guide bar edge being aligned with the drive sprocket,
a saw chain mounted on the drive sprocket and in the guide bar slot so as to be driven around the guide bar by the drive sprocket for cutting, the saw chain including centre drive links, the drive links having drive tangs that project into the guide bar slot to maintain lateral stability of the saw chain on the bar, and laterally opposed side links, the side links having bottom edge surfaces that engage the side rails of the guide bar to absorb the impact of cutting forces, and
an idler sprocket with outwardly projected teeth mounted in the guide bar nose end for lifting the saw chain said links off the guide bar side rails as the saw chain travels around the bar nose end,
characterised in that the nose sprocket teeth are configured to match the configuration of adjacent drive tangs as the saw chain travels in a curved path around the nose end of the bar, the configured teeth having leading and trailing contact faces that contact the trailing and leading flanks of the respective leading and trailing drive tangs to lift the saw chain and thereby the side links of the saw chain off the side rails, and the configured teeth tips terminate short of the point where the teeth tips would project between the side links.

3. A chain saw as claimed in claim 1 or 2, wherein the side link bottom edges have notches forming a centre bottom relief area and wherein the sprocket tooth tips project into the relief area and terminate below the notch top, whereby the tooth tip projects above the side link bearing surfaces without entering the space between the laterally opposed side links in the chain.

4. A method of producing a sprocket nose guide bar comprising the steps of:
(a) generating a facsimile of a bar nose of a guide bar to which a nose sprocket is to be fitted,
(b) laying out the desired path of travel of the bar edge of a saw chain in relation to the bar nose configuration,
(c) generating a saw chain facsimile of a section of the desired saw chain to be guided by the guide bar in a cutting action, the saw chain facsimile conforming to the path of travel laid out around the bar nose configuration, and the saw chain configuration comprising centre drive links having depending tangs and interconnected pairs of side links, and
(d) designing a nose sprocket to fit the bar nose configuration with the sprocket teeth fitted between the depending tangs and terminating below the bottom edge of the side links.

5. A method as claimed in claim 4, wherein the side link bottom edge configuration includes a centre notch and wherein the sprocket teeth are projected into the notch.

FIG. 1

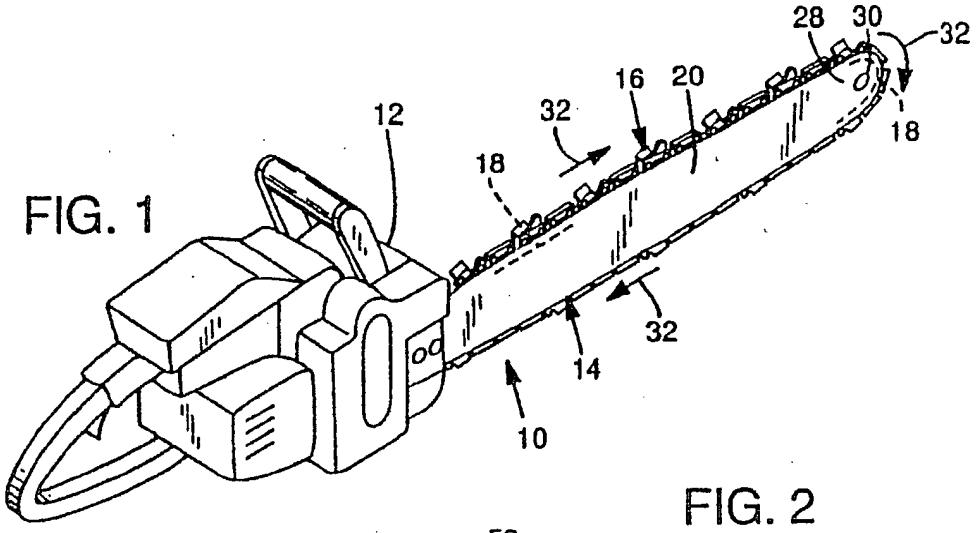

FIG. 2